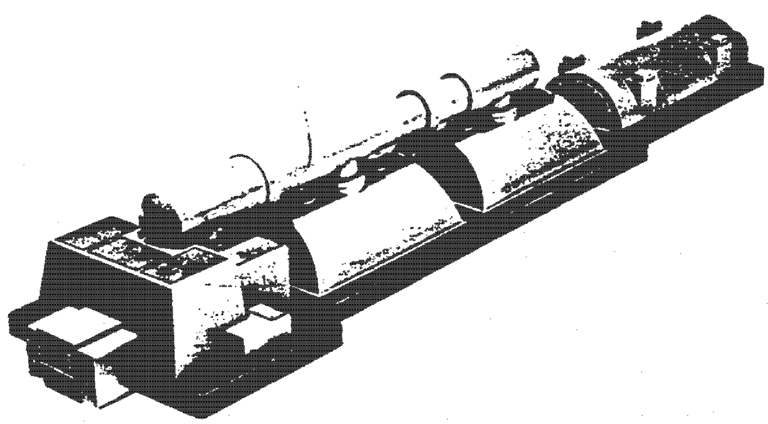
GET-2050B

# HEAT RATES
## FOR
# GENERAL ELECTRIC STEAM TURBINE-GENERATORS . . .
# 100,000 KW AND LARGER



LARGE STEAM TURBINE-GENERATOR DEPARTMENT
GENERAL ELECTRIC
SCHENECTADY, N. Y.

**Tandem-compound, 3600-rpm, and Cross-compound, 3600/1800-rpm**

1800 psig—Single-casing, opposed-flow, high-pressure, intermediate-pressure turbine.

2400 psig—Single-casing, opposed-flow, high-pressure, intermediate-pressure turbine through 550,000 kw.

Separate-casing, high-pressure and intermediate-pressure turbine above 550,000 kw.

3500 psig (Single reheat)—Single-casing, opposed-flow, high-pressure, intermediate-pressure turbine through 600,000 kw.

Separate-casing, high-pressure and intermediate-pressure turbine above 600,000 kw.

3500 psig (Double reheat)—Single-casing, opposed-flow, high-pressure, first-reheat turbine; separate-casing, 2-flow second-reheat turbine.

**Cross-compound, 3600/3600-rpm**

2400 and 3500 psig—Separate-casing high-pressure and intermediate-pressure turbine at all ratings.

The heat rates tabulated are representative of the performance for the design parameters in current use. The number of admissions, or more specifically, the throttle flow ratio (TFR) below which full throttling is assumed, has a considerable effect on light-load performance. The tabulation indicates for each unit the TFR at which throttling begins, and the heat rates reflect its effect on performance.

## DESIGN LIMITS

The units marked with an (*) in the tabulation have the maximum allowable exhaust flow for the type and number of rows of last-stage buckets (LSB) indicated. The indicated ratings are approximate and may vary considerably if the assumed cycle is altered. Limits are established at valves wide open, 5-percent overpressure and 3.5 in. Hg Abs and are:

| Last-stage Bucket Length (in.) | ($ft^2$) | Exhaust Flow (Lb/hr per row LSB) | ($lb/ft^2 h$) |
|---|---|---|---|
| 23 —3600 rpm | (31.9) | 494,000 | (15000) |
| 26 —3600 rpm | (40.8) | 616,000 | (15100) |
| 30 —3600 rpm | (55.6) | 805,000 | (14500) |
| 33.5—3600 rpm | (66.1) | 992,000 | (15000) |
| 38 —1800 rpm | – | 1,200,000 | – |
| 43 —1800 rpm | – | 1,560,000 | – |
| 52 —1800 rpm | – | 2,172,000 | – |

The tandem-compound, double-reheat units above 700,000 kw may be size limited by the exact cycle parameters required. Data have been provided for units in this rating range, to aid in optimization studies, but the availability of a unit of a specific rating will be determined by the General Electric Company, based on current design limits.

## EFFICIENCY LEVEL

The turbine-generator efficiency used in determining these heat rates is based upon that calculated from ASME Paper No. 62-WA-209, General Electric reprint GER-2007, titled "A Method for Predicting the Performance of Steam Turbine-Generators . . . 16,500 KW and larger" by R. C. Spencer, K. C. Cotton, and C. N. Cannon. While the performance of each individual unit in the tabulations has not been determined by heat balance, the basic information provided to a heat rate estimating method used to determine these tabulated heat rates is based entirely upon the efficiency method set forth in the above paper.

## CYCLE

The heat rate performance of turbine-generators is dependent not only on the turbine-generator efficiency, but also upon the cycle in which it is applied. The cycles used to determine these heat rates have been assumed to be 0.3-percent poorer than those used to prepare the relative net heat rates of Fig. 28, 29, and 30 in ASME Paper No. 62-WA-209. The cycle used for those relative heat rates (see Fig. 27, ASME Paper No. 62-WA-209 reproduced on the following page), is an idealized cycle in that the heater distribution is based upon thermodynamic considerations without regard for the extraction pressures available in actual turbine designs. In addition, the cycle is of better thermodynamic quality than is generally justified by today's economic and practical operating considerations. For instance, using the cycle configuration table discussed later, a cycle having a realistic heater distribution (2), the bottom heater at the L-2 stage (3) draining through ten-degree drain cooler to the condenser (5), and a five-percent flange to heater pressure drop (4) would be 0.3-percent poorer than the idealized cycle. Therefore, the heat rates provided in this tabulation are more representative of those obtained in present day turbine and station design. A further discussion of cycle variables is given below.

The steam conditions, final feedwater temperature, and number of heaters assumed to prepare the heat rates are indicated on each page of the tables. The final feedwater specified is obtained at valves-wide-open. All the cycles assume the highest pressure heater is at the cold reheat point.



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